Title

The role of healthcare and education systems in co-occurrence of health risk behaviours in 27 European countries

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Abstract

Background

Contextual factors play an important role in health and related behaviours. This study aims to examine the association of co-occurrence of 5 health risk behaviours with healthcare and education contextual factors using nationally representative samples from 27 European countries.

Methods

Data were from Eurobarometer 72.3, 2009. The outcome was a count variable ranging from 0 to 5 indicating co-occurrence of five health risk behaviours, namely smoking, excessive alcohol consumption, non-frequent fresh fruit consumption, physical inactivity and non-dental check-ups. Public expenditures on healthcare and education as a percentage of GDP and quality of healthcare and education at a country-level were used as contextual factors. A set of multilevel Poisson regression models were conducted to examine the associations between co-occurrence of health risk behaviours and each of the contextual factors considering age, gender, marital status, urbanisation, individual socioeconomic positions (education, subjective social status or difficulty in paying bills) and GDP per capita.

Results

The total population was 23,842. Greater expenditures on healthcare and education, and better quality of healthcare systems had negative associations with co-occurrence of health risk behaviours in the model adjusted for all individual demographic indicators. However, statistical significance disappeared after adjusting for socioeconomic indicators and GDP per capita.

Conclusion

While the study highlights the importance of developing high quality healthcare and education systems generously supported by public fund in relation to co-occurrence of health risk behaviours, the influence of contextual factors in adopting health-related behaviours is probably attenuated by individual socioeconomic factors.

Keywords:

Health behavior, Risk-taking, Health expenditures, Education, Europe

Introduction

Modifiable health-related behaviours tend to be grouped together in the same sectors of the population, with those at the bottom of the socioeconomic hierarchy more likely to engage in health-risk behaviours and less likely to adopted health-promoting ones.[1] Among these behaviours, the 'big four' behaviours, namely smoking, excessive alcohol consumption, poor diet and physical inactivity have been excessively studied in term of their devastating impact on mortality and morbidity, particularly cancer, cardiovascular disease and diabetes.[2-4] The same set of health-related behaviours is also related to oral health[5-8] in addition to dental check-ups.[9] Traditionally, epidemiological studies have focused on the significant impact of a single health risk behaviour on a specific health outcome.[10] However, co-occurrence of health risk behaviours in the same individuals, defined as a count number of health risk behaviours,[11] exerts multiplicative effects on disease risk.[12]

The social environment influences behaviour by shaping norms, enforcing patterns of health-related behaviours, providing or obstructing environmental opportunities to engage in certain behaviours.[1] Earlier studies have reported an association between co-occurrence of health risk behaviours and contextual factors, such as neighbourhood socioeconomic factors,[13] area-level deprivation[14] and workplace social capital.[15] Although the evidence has shown the influence of contextual factors on co-occurrence of health risk behaviours, to the best of our knowledge, no other study has examined the association between healthcare/education systems and co-occurrence of health risk behaviours.

Better healthcare systems could promote equitable access to preventive services,[16] and enhance perception of health security,[17] and subsequently reduce anxiety related to availability and quality of healthcare services at the time of sickness.[18] Such anxiety could impact on individual's psychosocial wellbeing which has an established association with adopting health-risk behaviours.[19] Similarly, equitable access to high quality education

system will enable equal opportunities to access high quality education, hence increasing the probabilities of having better jobs, and improving their chances for social mobility, and consequently reducing the social gradients in behaviours and health.[20] Furthermore, it would possibly impact on individual's ability to access and interpret information, improve sense of learnt effectiveness and personal control, particularly among the least affluent, hence leading to healthier lifestyles.[21] Thus, it is reasonable to hypothesise that healthcare and education systems can potentially influence co-occurrence of health risk behaviours.

Methods

Data source and study sample

This study is a secondary analysis of cross-country population-based data from Eurobarometer 72.3, which is a cross-sectional interview survey in Europe. This survey used nationally representative samples from each of the European countries and was conducted in October, 2009.[22] A 2-stage, random (probability) sampling design was used for sample selection. The data was collected by face-to-face interview in people's home from October 2 to 19, 2009 by the TNS Opinion and Social through its network of national institutes in the respective national language.[22] The regular sample size was 1,000 participants from each country. Intentionally more participants were selected from the respective group than would typically be done if everyone in the sample had an equal chance of being selected.[25]

We included participants from 27 European Union countries who answered all questions pertaining to health-related behaviours and demographic/socioeconomic indicators. Given that smoking and drinking are illegal for those under 18 years in most of the European countries, the analysis was limited to those aged 18 and over. Ethical approval was not required for this secondary data analysis.

Variables

Outcome

The survey had the questions related to check-up and medical screening, oral health, alcohol habits, smoking habits, and sport and physical activity. We selected the five behaviours, namely smoking, alcohol use, diet, physical activity and dental check-ups because of their relationships with a number of chronic diseases and with oral health. In addition, these five health-related behaviours had similar socio-demographic determinants. The co-occurrence of health risk behaviours was estimated based on how many of the following 5 health-risk behaviours participants reported: smoking, excessive alcohol consumption, infrequent consumption of fresh fruits, physical inactivity and not attending dental check-ups. The behaviours were dichotomised into binary options (health risk behaviours were coded as 1, while all health promoting behaviours were coded as 0) (Table 1). Smoking was indicated by current smokers (versus former- or never- smokers). Excessive alcohol consumption was defined as having 5 or more drinks on one occasion at least once a week in the last 12 months. Infrequent consumption of fresh fruits was indicated by consuming fresh fruits "from time to time", "rarely" or "never". Physical inactivity was created by combining 2 questions. EU Working Group indicated that physical activity at least 5 times a week is recommended for European adults.[23] As the dataset did not allow using this definition, in this study at least 4 times a week was used as a cut-off point for physical activity.[24] Dental check-ups were indicated by use in the past 12 months. According to the NICE guideline, people who are not at risk of or from oral disease may not need dental check-ups once a year.[25] However, given this is a sample of the whole population including those with at higher risk of oral diseases, we thought dental visit during the past 12 months, which was included in the survey, would be a reasonable cut-off point.

Country-level independent variables

National public expenditure on health and education and quality of healthcare and education systems were used as the contextual exposures of interest. Five-year average public expenditure on health as a percentage of GDP in each country from 2005 to 2009 reported by the World Bank[26] was calculated and used as health expenditure. Quality of healthcare system was indicated by Euro Health Consumer Index.[27] Euro Health Consumer Index consisted of 38 indicators of 6 sub-disciplines: (1) Patient rights and information, (2) e-Health, (3) Waiting time for treatment, (4) Outcomes, (5) Range and reach of services and (6) Pharmaceuticals. For each of the sub-domains, the country score was calculated as a percentage of the full score.[27] The scores were divided by 100 for better interpretations of the results and used as an indicator of the quality of healthcare system in this study.

Five-year average public expenditure on education as a percentage of GDP in each country from 2005 to 2009 by Eurostat[28] were calculated and used as education expenditure. Quality of education system was indicated by the Education for All Development Index (EDI) in 2006.[29] EDI is used as a proxy measure for each of the four "Education for All" goals, and each of these EDI components is assigned equal weight in the overall index in accordance with the principle of considering each goal as being of equal importance. The EDI value for a given country is the arithmetic mean of the four proxy indicators, namely universal primary education (the percentage of primary-school-age children who are enrolled in either primary or secondary school), adult literacy (the adult literacy rate for those aged 15 and above), quality of education (the survival rate to Grade 5) and gender (a simple average of the three gender parity indexes (GPI) for primary education, secondary education and adult literacy, with each being weighted equally). The percentage of the score was used in this study. Given that expenditure on healthcare and education can be susceptible to economic condition of the country, we included Gross Domestic Product (GDP) per capita in the analysis.

Individual-level independent variables

Socioeconomic position was indicated by 3 measures, namely education, subjective social status and difficulty in paying bills. Education was measured by the age when participants stopped full-time education, and was categorised into 3 groups; 20 years and older, 16-19 years old and 15 years or less. This is because in most European countries the minimum age for compulsory education is 15 years or older, and secondary school education is usually completed when individuals are under 20 years.[30]. Participants still studying were included in the category corresponding to their age. Education is an important indicator of socioeconomic position as it is comparable across countries.[31] Subjective social status reflects one's perception of own status in the respective community/country, and is an important determinant for health-related behaviours.[32] In this survey, participants were asked to place themselves on a ladder indicating their perception of own positions in their respective society on a scale of 1-10, hence reflecting perception of social standing. For better interpretation of the data and to distinguish between the upper and the lower halves of the scale, subjective social status was categorised into quartiles. The quartiles indicted: highest (step 7-10), second highest (step 6), second lowest (step 5) and lowest (step 1-4). Difficulty in paying bills reflects financial ability to pay bills at the end of the month during the last 12 months, and has 3 categories; most of the time, from time to time and almost never/ never, which was used in previous studies.[33]

Demographic factors included gender, age, urbanisation and marital status. Age was used as a continuous variable. Urbanisation has 3 categories (rural area or village, small or middle sized town and large town). Marital status was dichotomised to indicate; married/living with a partner, versus single/divorced/separated/widowed. The selection of the variables included in the models were based on their relationships with the outcome variable and with the main exposure. For example, expenditures on health and education are relevant to the country GDP,

therefore inclusion of such a variable could affect the relationship between the exposure and the outcome variable.

Statistical analysis

In order to examine the associations between co-occurrence of health risk behaviours and each of contextual factors, a two-level Poisson regression model with log link function[34] was conducted because the response variable was a count and the mean (1.70) was almost the same as variance (1.41) for this variable (range: 0-5). The fixed- and random-parameter estimates for the two-level Poisson regression models were calculated by MLwiN version 2.35 using the iterative generalised least squares algorithm with the penalised quasi-likelihood (PQL), second-order approximation procedure.[35] We did not use weight for the multilevel analyses because when the cluster sizes are large (approximately 750 individuals in each cluster), the standard errors achieved remarkable consistency either weighted or unweighted.[36] Three multilevel models were constructed for each of contextual factors. The construction of the models aimed at examining binary association between contextual factors and behaviours, then adjusted for demographic factors and finally, included socioeconomic factors at the country and individual levels. Model 1 examined the associations between co-occurrence of health risk behaviours and each of contextual factors adjusted for all demographic characteristics (age, gender, marital status and urbanisation). Model 2 was adjusted for all demographic characteristics and the 3 socioeconomic indicators. Finally, Model 3 was additionally adjusted for GDP per capita of each country. In each model, rate ratios were reported for fixed parts. For random parts, the proportional change in inter-country variance estimates (σ^2) of the different model was imputed. A median rate ratio, which is the median of the rate ratios of pair-wise comparisons of countries, was calculated as $e \wedge (0.954*\sqrt{\sigma^2})$.[37]

Results

After excluding the participants with missing values, 23,842 individuals were included in this study (the valid percentage is 91.7%). The weighted percentages of each health risk behaviour among the total population were 30.0% for smoking, 22.4% for excessive alcohol consumption, 36.9% for infrequent fresh fruit consumption, 50.7% for physical inactivity and 36.8% for non-use of dental check-ups. Participants reported no health risk behaviours were 14.9% (n=3,897). The most frequent co-occurrence numbers were 1 and 2 health risk behaviours with 29.3% (n=7,311) and 29.8% (n=6,835) respectively. Those with 3 health risk behaviours accounted for 17.9% (n=4,025) with 6.5% (n=1,440) for 4 health risk behaviours, 1.7% (n=334) for 5 health risk behaviours and 16.4% (n=3,897) for 0 health risk behaviour.

The mean number of health risk behaviours was 1.70 (SD = 1.19, Variance = 1.41, Median = 2.5). The individual- and country-level predictor variables are presented in Table 2. The results of multilevel Poisson regression models examining the associations between co-occurrence of health risk behaviours and contextual factors are presented in Tables 3 and 4. In an empty model, variance at country-level was 0.023 (SE: 0.006), hence the median of all pairwise comparisons between countries gives a rate ratio of 1.16 (95% CI: 1.14, 1.17). This indicated that there were variations in co-occurrence of health risk behaviours between countries. A unit increase in health expenditure was associated with lower risk of co-occurrence of risk behaviours with the rate ratio of 0.96 (95% CI: 0.93, 0.99) in the model accounting for all demographic factors (Table 3). After accounting for socioeconomic positions, the association lost significance. Individuals in the countries with higher quality of healthcare system were less likely to have health risk behaviours with the rate ratio of 0.93 (95% CI: 0.88, 0.97) in the model accounting for all demographic factors, again statistical significance disappeared after adjusting for socioeconomic position and GDP per capita.

In the analysis pertaining to education domain, people in the country with higher education expenditure had less number of health risk behaviours with the rate ratio of 0.95 (95% CI:

0.90, 0.99) for 1% increase of public expenditure on health in the model accounting for all demographic factors (Table 4). On the other hand, the association between quality of education system and the co-occurrence of health risk behaviours was not significant in any models.

In the fully adjusted models, there were clear socioeconomic gradients in the number of co-occurrence of health risk behaviours for all 3 socioeconomic indicators. Those with the lowest socioeconomic position had higher number of co-occurrence of health risk behaviours than those with the highest socioeconomic position (Tables 3 and 4).

Discussion

In this study, we examined the associations between co-occurrence of health risk behaviours and contextual factors related to healthcare and education systems in 27 European countries. The results indicate the presence of a relatively modest and inverse association between better quality of healthcare system, and greater public expenditure on healthcare and education systems and co-occurrence of health risk. However, these associations were attenuated and lost statistical significance after accounting for individual-level socioeconomic factors and country-level GDP per capita, thus highlighting a possibility of mediation effect of individual's socioeconomic factors in the associations.

It is worth noting that different indicators of individuals' socioeconomic position reflecting perception of social position, material ability and education were all significantly associated with co-occurrence of health risk behaviours. The findings also highlighted the importance of other individual level characterises such as gender, living area, and age. The observations about these individual characteristics were in line with the previous studies.[38, 39]

While these findings clearly demonstrate the persistence of socioeconomic inequalities in adopting a number of health risk behaviour, it also indicates a potential role of these country-

level contextual factors in individual-level socioeconomic factors, which are often neglected in research on co-occurrence of behaviours. Expenditures on healthcare and education at a country-level reflect the countries' commitments to the population welfare that would enhance a sense of security and equality. These features were found to be associated with adopting health risk behaviours.[1]

Healthcare system enables equitable access and effective use of health promoting resources by eliminating health insecurity, and related anxieties and financial distress.[18] Similarly, high quality education can improve health literacy and acquisition of knowledge related to enhancing health-related behaviours.[21] This in turn enhances the population abilities to adopt health-promoting behaviours and avoid health risk behaviours. The findings of this study to some extent were in line with previous studies which examined the association of co-occurrence of health risk behaviours with other contextual factors, such as neighbourhood socioeconomic factors, social capital at workplace and area-level socioeconomic deprivation; where worse contextual conditions were related to higher number of co-occurrence of health risk behaviours.[13-15].

While a previous study found a positive association between health and education spending at country-level and physical activity regardless of socioeconomic status in Europe,[33] the study however did not account for GDP and used different definition of physical activity from the one used here. In the current study, adjusting for GDP and individual socioeconomic factors eliminated the significant association between expenditure of health and education and co-occurrence of health risk behaviours.

Although a negative association between contextual factors related to healthcare and education systems and co-occurrence of health-risk behaviours was implied, the association was not strong. A possible explanation would be the known correlation between contextual factors related to education and individual-level socioeconomic factors. In other words,

greater public expenditure is highly correlated with education at the individual level, hence the inclusion of education in the analytical model significantly attenuates any the association between public expenditure on education and health behaviours. It is also possible that in countries with generous healthcare systems, some people take less responsibility for their own health and engage in health risk behaviours. Finally, there is very small variation in the contextual factors in the EU countries. This undoubtedly contributed to the relatively weak association observed in this study.

The findings on co-occurrence of health risk behaviours and their association with contextual factors and individual socioeconomic position also emphasise the need to adopt a holistic approach addressing multiple health behaviours rather than a single behaviour approach.

There are some limitations. Firstly, this is a cross-sectional study, therefore cannot establish causality. Secondly, because the survey was self-reported, the response might be over-reported or under-reported, especially, health risk behaviours and socioeconomic position. Thirdly, this study included 27 countries, which might not be a sufficiently large number for assessing variation in multilevel analysis. Furthermore, the terms of joining the European Union include having consistent policies, hence the variations between EU countries are very small. The cut-off points of some of the health-related behaviours did not perfectly match the guidelines or optimal behaviours, however, we used the closest cut-off points to the guidelines. Finally, participants with missing data were excluded throughout the analyses, which might a potential for selection bias, although the excluded number was relatively small.

This is the first study, which examined the associations between co-occurrence of health risk behaviours and healthcare and education systems at the country level using multilevel analysis. While the study highlights the importance of developing high quality healthcare and education systems, generously supported by public fund in relation to co-occurrence of health

risk behaviours, the association might be attenuated by individual socioeconomic factors because of the possible association with country-level contextual factors.

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The authors declare that they have no relevant financial relationships.

Conflict of interest

None declared.

Keypoints

- Better quality of healthcare system appeared to be inversely related to co-occurrence of health risk behaviours.
- Greater public expenditure on healthcare and education appeared to be inversely related to co-occurrence of health risk behaviours.
- Individual socioeconomic positions might attenuate the associations between co-occurrence of health risk behaviours and healthcare/education systems in Europe.
- The findings will potentially enable identifying population/countries with greater needs for health promotion policies aiming at reducing multiple health risk behaviours.

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Table 1. Measurement of health-risk behaviours

	Measurement in the survey	**Classification of health-risk behaviours for this study**
Smoking	Regarding smoking cigarettes, cigars or a pipe, which of the following applies to you?: (1) you smoke at the present time, (2) you used to smoke but you have stopped, (3) you have never smoked and (4) don't know.	Smoking at the present time
Excessive alcohol consumption	How often in the past twelve months have you had five or more drinks on one occasion?: (1) several times a week, (2) once a week, (3) once a month, (4) less than once a month, (5) never, and (6) don't know/refusal.	Having 5 or more drinks on one occasion at least once a week in the last twelve months
Infrequent consumption of fresh fruits	How often do you eat fresh fruit?: (1) often, (2) from time to time, (3) rarely, (4) never and (5) don't know.	Consuming fresh fruit from time to time, rarely or never
Physical inactivity	There are two questions: (a) how often the person exercises or plays sport, (b) how often the participant engages in a physical activity outside sport such as cycling or walking from a	Doing physical activity less than four times a week (Except the participates who answered: (1) five times a week or more for either the two questions regardless of any other answer; those who answered (2) three to four

	place to another, dancing, gardening etc. For each of the questions; (1) five times a week or more, (2) three to four times a week, (3) one to two times a week, (4) one to three times a month, (5) less often, (6) never, and (7) don't know.	times a week for either question and (2) three to four times a week or (3) one to two times a week for another question)
Not attending dental check-ups	Did you have dental check-ups in the last twelve months, whether or not as part of any treatment?: (1) yes, own initiative, (2) yes, doctor's initiative, (3) yes, screening programme, (4) no, and (5) don't know.	Having dental check-ups in the last 12 months regardless own initiative, doctor's initiative or screening programme

Table 2. Data description for the final sample

Level 1: Individual-level predictor variable (N = 23,842)		**N**	**Weighted %**	**(95%CI)**
			Mean±SE	
Gender				
	Male	10453	48.00	(47.00, 49.01)
	Female	13389	52.00	(50.99, 53.00)
Age in years		23842	47.71±0.18 (Range: 18-96)	
Marital status				
	Married/with a partner	15608	65.77	(64.82, 66.71)
	Single	8234	34.23	(33.29, 35.18)
Urbanisation				
	Rural area/village	8624	34.79	(33.84, 35.75)
	Small/middle-sized town	8360	39.94	(38.95, 40.93)
	Large town	6858	25.28	(24.44, 26.13)
Education				

	20 years or older	7574	29.48	(28.58, 30.39)
	16-19 years old	11103	46.48	(45.48, 47.48)
	15 years old or less	5165	24.05	(23.20, 24.91)
Subjective social status				
	Highest	6889	27.21	(26.34, 28.10)
	Second highest	5091	24.28	(23.42, 25.17)
	Second lowest	6934	29.94	(29.03, 30.88)
	Lowest	4928	18.56	(17.81, 19.34)
Difficulty in paying bills				
	Almost never/never	15292	66.16	(65.22, 67.09)
	From time to time	6351	26.16	(25.30, 27.05)
	Most of the time	2199	7.67	(7.18, 8.19)

Level 2: country-level predictor variable (N = 27)	**Mean**	**Standard Deviation**	**Variance**	**Range**
Healthcare expenditure (% of GDP)	6.32	1.50	2.26	2.8 - 8.7
Quality of healthcare	6.65	1.06	1.12	4.48 - 8.75
Education expenditure (% of GDP)	5.25	1.01	1.02	6.45 - 8.10

Quality of education	98.15	0.95	0.91	95.5 - 99.4
GDP per capita (in US dollars/1000)	31.93	17.98	323.43	6.74 - 100.74

Table 3. Rate ratios for the associations between Healthcare domain and co-occurrence of health risk behaviours from multilevel Poisson regression models

(N=23842; Eurobarometer 72.3, 2009)

	Health expenditure			**Quality of healthcare**		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	RR (95%CI)	**RR (95%CI)**	**RR (95%CI)**	**RR (95%CI)**	**RR (95%CI)**	**RR (95%CI)**
Fixed						
Country-level variables						
Health expenditure	0.96* (0.93, 0.99)	0.98 (0.96, 1.01)	0.99 (0.96, 1.03)			
Quality of healthcare				0.93* (0.88, 0.97)	0.97 (0.93, 1.01)	0.98 (0.92, 1.04)
GDP per capita			0.99 (0.99, 1.00)			0.99 (0.99, 1.00)
Individual-level variables						
Age in years	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)
Gender (ref: male)						
Female	0.74* (0.73, 0.76)	0.74* (0.72, 0.75)	0.74* (0.72, 0.75)	0.74* (0.73, 0.76)	0.74* (0.72, 0.75)	0.74* (0.72, 0.75)
Marital status (ref: married individuals)						
Single	1.14* (1.11, 1.16)	1.11* (1.09, 1.13)	1.11* (1.09, 1.13)	1.14* (1.11, 1.16)	1.11* (1.09, 1.13)	1.11* (1.09, 1.13)
Urbanisation (ref: rural area or village)						
Small/middle sized town	1.02 (0.99, 1.05)	1.04* (1.01, 1.06)	1.04* (1.01, 1.06)	1.02 (0.99, 1.05)	1.04* (1.01, 1.06)	1.04* (1.01, 1.06)

Large town	1.04* (1.01, 1.07)	1.07* (1.04, 1.09)	1.07* (1.04, 1.09)	1.04* (1.01, 1.07)	1.07* (1.04, 1.09)	1.07* (1.04, 1.09)
Education (ref: 20 years or older)						
16-19 years		1.15* (1.13, 1.18)	1.15* (1.12, 1.18)		1.15* (1.12, 1.18)	1.15* (1.12, 1.18)
15 years or less		1.23* (1.19, 1.27)	1.23* (1.19, 1.27)		1.23* (1.19, 1.27)	1.23* (1.19, 1.27)
Subjective social status (ref: highest)						
Second highest		1.08* (1.05, 1.11)	1.08* (1.05, 1.11)		1.08* (1.05, 1.11)	1.08* (1.05, 1.11)
Second lowest		1.07* (1.04, 1.11)	1.07* (1.04, 1.11)		1.07* (1.04, 1.11)	1.07* (1.04, 1.11)
Lowest		1.17* (1.13, 1.21)	1.17* (1.13, 1.20)		1.17* (1.13, 1.21)	1.17* (1.13, 1.20)
Difficulty in paying bills (ref: never)						
From time to time		1.16* (1.14, 1.19)	1.16* (1.14, 1.19)		1.16* (1.14, 1.19)	1.16* (1.14, 1.19)
Most of the time		1.29* (1.25, 1.33)	1.29* (1.25, 1.33)		1.29* (1.25, 1.33)	1.29* (1.25, 1.33)
Random						
σ^2	0.018	0.011	0.010	0.016	0.010	0.010
(SE)	0.005	0.003	0.003	0.004	0.003	0.003
MRR	1.14	1.11	1.10	1.13	1.10	1.10
(95% CI for MRR)	(1.13, 1.15)	(1.10, 1.11)	(1.09, 1.11)	(1.12, 1.14)	(1.09, 1.11)	(1.09, 1.11)

Model 1: considering individual-level demographic characteristics, Model 2: considering individual-level demographic and socioeconomic characteristics, Model 3: considering individual-level characteristics and country-level variable (GDP per capita)

*$p<0.05$

Table 4. Rate ratios for the associations between Education domain and co-occurrence of health risk behaviours from multilevel Poisson regression models

(N=23842; Eurobarometer 72.3, 2009)

	Education expenditure			Quality of education		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	RR (95%CI)	**RR (95%CI)**	**RR (95%CI)**	**RR (95%CI)**	**RR (95%CI)**	**RR (95%CI)**
Fixed						
Country-level variables						
Education expenditure	0.95* (0.90, 0.99)	0.97 (0.94, 1.01)	0.98 (0.94, 1.01)			
Quality of education				0.95 (0.90, 1.00)	0.98 (0.94, 1.03)	1.00 (0.95, 1.05)
GDP per capita			0.99 (0.99, 1.00)			0.99 (0.99, 1.00)
Individual-level variables						
Age in years	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)	0.99* (0.99, 0.99)
Gender (ref: male)						
Female	0.74* (0.73, 0.76)	0.74* (0.72, 0.75)	0.74* (0.72, 0.75)	0.74* (0.73, 0.76)	0.74* (0.72, 0.75)	0.74* (0.72, 0.75)
Marital status (ref: married individuals)						
Single	1.14* (1.11, 1.16)	1.11 (1.09, 1.13)	1.11* (1.09, 1.13)	1.14* (1.11, 1.16)	1.11* (1.09, 1.13)	1.11* (1.09, 1.13)
Urbanisation (ref: rural area or village)						
Small/middle sized town	1.02 (0.99, 1.05)	1.04* (1.01, 1.06)	1.04* (1.01, 1.06)	1.02 (0.99, 1.05)	1.04* (1.01, 1.06)	1.04* (1.01, 1.06)

Large town	1.04	1.07*	1.07*	1.04*	1.07*	1.07*
	(1.01, 1.07)	(1.04, 1.09)	(1.04, 1.09)	(1.01, 1.07)	(1.04, 1.09)	(1.04, 1.09)
Education (ref: 20 years or older)						
16-19 years		1.15*	1.15*		1.15*	1.15*
		(1.12, 1.18)	(1.12, 1.18)		(1.13 1.18)	(1.12, 1.18)
15 years or less		1.23*	1.23*		1.23*	1.23*
		(1.19, 1.27)	(1.19, 1.27)		(1.19, 1.27)	(1.19, 1.27)
Subjective social status (ref: highest)						
Second highest		1.08*	1.08*		1.08*	1.08*
		(1.05, 1.11)	(1.05, 1.11)		(1.05, 1.11)	(1.05, 1.11)
Second lowest		1.08*	1.07*		1.08*	1.07*
		(1.05, 1.11)	(1.04, 1.11)		(1.05, 1.11)	(1.04, 1.11)
Lowest		1.17*	1.17*		1.17*	1.17*
		(1.13, 1.21)	(1.13, 1.20)		(1.13, 1.21)	(1.13, 1.21)
Difficulty in paying bills (ref: never)						
From time to time		1.16*	1.16*		1.16*	1.16*
		(1.14, 1.19)	(1.14, 1.19)		(1.14, 1.19)	(1.14, 1.19)
Most of the time		1.29*	1.29*		1.29*	1.29*
		(1.25, 1.34)	(1.25, 1.33)		(1.25, 1.33)	(1.25, 1.33)
GDP per capita			0.99			0.99
			(0.99, 1.00)			(0.99, 1.00)
Random						
σ^2	0.019	0.010	0.010	0.020	0.011	0.010
(SE)	0.005	0.003	0.003	0.006	0.003	0.003
MRR	1.14	1.10	1.10	1.14	1.11	1.10
(95% CI for MRR)	(1.13, 1.15)	(1.09, 1.11)	(1.09, 1.11)	(1.13, 1.16)	(1.10, 1.11)	(1.09, 1.11)

Model 1: considering individual-level demographic characteristics, Model 2: considering individual-level demographic and socioeconomic characteristics, Model 3: considering individual-level characteristics and country-level variable (GDP per capita)